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ABSTRACT

This paper describes the U.S. experience in providing vocational training to the low-literate. Chapter I presents an overview of the problem. It discusses the changing nature of work, the workplace, the worker, and vocational training itself. Chapter II describes the U.S. experience in the training of low-literates. The approaches, methods, and techniques developed in the United States to train individuals with low literacy levels (ILLs) are examined. They include the "functional context" approach to instruction (the most efficient and cost-effective method) and the "Comprehensive Competencies Program." The microcomputer, videodisc, and compact and optical discs are discussed in terms of their practical applications in the design, development, delivery, management, and evaluation of training programs. Chapter II proposes guidelines for the development of vocational training programs for the low-literate based on relevant U.S. experience. The guidelines will need to be adapted according to the varying conditions for literacy from country to country. Chapter IV presents six case studies that exemplify the U.S. experience in vocational training for individuals with low literacy levels. A developmental model of literacy and a bibliography are appended. (YLB)

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The principal author of this report is Dr. David E. BARBEE, Consultant to the Center for Advanced Learning Systems (CALS) of the U.S. Department of Labor. The report was prepared from known sources and does not contain original research conducted by the CALS.

VOCATIONAL TRAINING BRANCH

Discussion Paper No. 1

METHODS OF PROVIDING VOCATIONAL SKILLS TO INDIVIDUALS WITH LOW LITERACY LEVELS: THE U.S. EXPERIENCE

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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TABLE OF CONTENTS

Chapter			Page Numbers
		Preface	v
I.		Statement of the Problem	1
	A.	The low-literate in the United States	1
	B.	The changing nature of work	2
	C.	The changing workplace	3
	D.	The changing view and expectations of labour	6
	E.	The changing nature of training	6
II.		The U.S. Experience in the Vocational-Technical Training of Low-Literates	10
	A.	Factors influencing the low-literate in the U.S.	10
	B.	What has been learned in the training of low-literates?	12
	C.	What methods and techniques have been developed in the U.S. to train the low-literate?	18
	D.	What new technologies hold promise for the training of low-literates ?	22
III.		Guidelines for the Development of a System for the Vocational-Technical Training of Low-Literates	25
IV.		Case Studies that Exemplify the U.S. Experience in the Training of the Low-Literate	30
No.1		Project 100,000	30
No.2		Training for Cast-Off Youth	30
No.3		The Development of Two Job-Related Literacy Programmes	36
No.4		Programmes for Improving Occupationally Related Basic Skills	42
No.5		Experimental Functional Skills Programme in Reading (XFSP/Read)	54
No.6		The U.S. Department of Labor's "Job Corps"	60
		Annex I: A Developmental Model of Literacy	63
		Bibliography	67

PREFACE

This discussion paper is the first of a series of contributions to a research project carried out by the International Labour Office on "Methods of providing vocational skills to individuals with low literacy levels." It was prepared by the Center for Advanced Learning Systems (CALS) of the Bureau of International Labor Affairs, U.S. Department of Labor. As the original paper was very comprehensive, parts of it have been summarised and case studies have been condensed to allow publication of a concise discussion paper.

Despite substantial gains in literacy achieved by most developing countries in recent years, the number of individuals with low literacy levels (ILLL's) is high and rising. Because adults usually constitute the majority of illiterates, illiteracy represents an economic as well as a socio-cultural problem. Moreover, the problem of illiteracy is compounded by the high number of semi-literate and school drop-outs, and this large group of individuals with little or no educational background faces a number of problems:

- they are disproportionately represented among the poor, the unemployed and the under-employed;
- they typically bear the cultural and socio-economic stigma that they are not productive members of society;
- as they do not fulfil entry requirements, they are unable to participate in most formal or traditional non-formal training schemes and programmes;
- because they are often unable to acquire skills, they have little hope of finding regular employment, are barred from many occupations and their illiteracy places a low ceiling on any career development.

Evidence indicates that well-designed training programmes can offset the disadvantages illiterate individuals face in the labour market. New instructional concepts and technologies exist which can be used to transmit employable and income-earning skills to ILLL's. However, in view of the financial constraints existing in most developing countries, efficient and low-cost ways must be found to create new and expand existing training programmes so that the low-literate may participate, if they are not to remain on the fringe of the training system.

The objectives of this research project are to examine vocational training schemes and techniques for individuals with low or no literacy; to analyse how effective they have been in providing training for employment and other income-earning activities; to examine major difficulties encountered and ways to overcome them; to review technical, financial, institutional and socio-cultural implications in the planning and implementation of various types of training schemes and projects for individuals with low literacy levels; to review the specific methods used to provide skills to this group, including conventional methodologies, instructional materials, mass media and the newer instructional technologies.

The Vocational Training Branch of the ILO has commissioned a number of contributions on topics related to the major subject of "training for people with low literacy levels", as well as case studies on specific programmes or country experiences to be compiled by organisations and individuals with experience in this field in both industrialised and developing countries. The synthesis and analysis of these contributions and feedback thereto will help to identify successful training schemes both new and conventional, and to examine the background of and reasons for their development. It is hoped that conclusions drawn from this analysis will contribute to the overall goal of this research project, that is, to provide practical guide-lines for national and project staff responsible for relevant training projects and schemes on all aspects of planning and implementing such schemes, at pilot, local and national levels.

The present paper describes the U.S. experience in providing vocational training to the low-literate. The principal conclusion is that for the adult worker in the United States, the most effective way to acquire literacy and technical skills is to learn them together in a training programme tailored to the needs of the individual trainee. It was found that teaching literacy and technical skills separately is less efficient. As job requirements change, people must develop new skills to keep pace. Workers need to be more and more literate in order to perform new job tasks. To teach technical skills without teaching literacy skills may condemn the trainee to a "dead-end" job, thereby defeating the very purpose of the training.

The report consists of four chapters. Chapter I presents an overview of the problem. The author discusses the changing nature of work, the workplace, the worker and vocational training itself. As new technologies play a greater role in producing goods and services, requirements for teamwork, for information-processing and handling and for technical literacy are on the rise. Workers need to upgrade basic reading, writing and computing skills as well as to acquire advanced skills such as problem-solving and critical thinking. The nature of training is changing as more resources are applied to the design and development of training programmes than to their delivery.

Chapter II describes the U.S. experience in the training of low-literates. The approaches, methods and techniques developed in the U.S. to train ILLL's are examined. It has been found that the "functional context" approach to instruction is the most efficient and cost-effective method for teaching the low-literate as it builds on the individual's existing base of knowledge. The "Comprehensive Competencies Programme" is a successful approach that provides individualised basic skills training, including literacy, and can be readily adapted to a broad range of instructional environments. The micro-computer, video-disc and compact and optical discs find numerous practical applications in the design, development, delivery, management and evaluation of training programmes.

Chapter III proposes guidelines for the development of vocational training programmes for the low-literate based on relevant U.S. experience. It is noted, however, that these guidelines will need to be adapted according to the varying conditions for literacy from country to country.

Chapter IV presents six case studies which exemplify the U.S. experience in vocational training for individuals with low literacy levels.

Note: This paper has not been formally edited.

CHAPTER I

STATEMENT OF THE PROBLEM

There is substantial evidence that the requirements for literacy in the U.S. are increasing both on-the-job and in the home. The illiterate person in U.S. society is often relegated to a "dead end job" and a substandard life in many respects. Society loses because the "low-literate" does not achieve full productivity nor full intellectual development. The definition of literacy is also changing as technology becomes more and more sophisticated and we move further into the "Information Age".

For many years literacy meant an ability to read and write. More recently, most of the activities included in adult basic education have been included in the definition: reading, writing, mathematics, and the skills of living. Our technological age of information is beginning to expand it even further to include problem-solving, critical thinking and other skills required in many of the jobs emerging as a result of applying technology, automation and growing information-handling requirements. Functional literacy, once defined as a 5th grade reading level, is being redefined by many in the U.S. as the literacy requirements of jobs and living move steadily upward. The average job in the U.S. requires a 10th to 12th grade reading level, computational and mathematical literacy skills nearly as high, and increasing requirements for problem-solving and critical thinking.

A. The Low-literate in the United States

To date, no studies have been conducted on the extent of illiteracy in the U.S. A study often used in making such estimates is the adult performance level survey (APL) conducted in 1973-74 of a sample of 7,500 adults representative of the U.S. population. In this survey it was found that 20% of the adult population of the U.S. is "functionally incompetent" in terms of basic survival skills -- such as reading a help wanted advertisement, or correctly writing a check. This study also found that 35% of the unemployed, fell into this category and among the employed, unskilled and semiskilled workers had the lowest performance levels. In addition it was found that another 30% of the population were only "marginally competent". (Adult Functional Competency, 1975).

The U.S. Department of Education applied the APL findings to the 1982 population, estimating that 27 million adults were functionally illiterate and another 47 million adults could not function proficiently. This 74 million has been used in estimating the number of adults in need of basic education including reading, writing, math and functional skills. (Delker, 1983, p.33).

A number of these "low-literates" have been able to "get along" on-the-job and in their personal lives by compensating in a variety of ways, such as: asking someone to look up a number in the telephone directory because they have forgotten their glasses, asking a fellow worker to look up something for them in a manual or watching television to get their information rather than from a newspaper, magazine or book. Again estimates vary, but it is thought that perhaps as many as 18% or 19% of the 20%, fall into this category. The 1% to 2% that form the "hard core" illiterate, are not functioning in society and form the core of the unemployed, the welfare recipient and to a major degree the incarcerated in the U.S. (Sticht, 1986, informal discussion).

There are indications that as jobs continue to increase in their requirements for literacy, more of these marginally functional adults will join the "hard core", at least in their ability to find and hold other than "dead end" jobs. A number of studies have shown that there is substantial economic and social advantage for both the individual and society when "low-literates" are assisted in improving their basic skills.[1] (OTA, 1985).

B. The Changing Nature of Work

The nature of work in the U.S. and other industrialised countries is changing. As new jobs are created and old jobs disappear, new levels and types of basic skills for employment are also created. Jobs that are projected for greatest growth, like industrial robot production, geriatric social worker or energy technician, generally require higher levels of literacy, while those on the decline such as farm labourers, logging workers, or housekeepers require lower levels of literacy. Requirements for literacy and its breadth of application are increasing in many occupations, particularly with respect to applying basic skills to problem solving. Very few occupations require no reading, writing or mathematical skills, and

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1 Throughout this paper, the term "basic skills" means reading, writing and arithmetic skills.

increasing amounts of time are being devoted to working at computer or word processing terminals, with charts, graphs and tables, and with reference manuals. The difficulty level of much reading material on jobs is now in the 10th-12th grade level range, far above the 5th or 6th grade level of reading traditionally thought to be required for functional literacy. There are indications that even literate entry level workers may have some difficulty applying their basic skills in the workplace where reading, writing and computation are used to accomplish tasks and make assessments rather than to gather facts for passing tests.(Sticht, 1983).

While job tasks require higher levels of reading-to-do and other basic skills in their performance, the upward mobility of the worker is dependent upon reading-to-learn and other tools of learning to keep pace with rapid change. The Education Commission of the States' Task Force on Education for Economic Growth puts it this way:

> "The ...demands of advancing technology will almost certainly mean that real opportunity, real chances for upward mobility, will increasingly be reserved for those with learning-to-learn skills...problem-solving, reasoning, conceptualising, and analysing.... People who have only today's basic skills...will be consigned to economic stagnation."(ECS, 1983).

C. The Changing Workplace

In the U.S., more than 21 million new jobs have been generated over the past ten years, 90% in small businesses with less than 500 people.

- 8 million of these jobs have been generated since 1982.
- Over 600,000 new companies are incorporating each year; in 1984, 640,000 new businesses formed while only 15,000 failed.
- Only 10% of new businesses are "high tech". Each high-tech job creates 5 to 15 support jobs representing the whole spectrum of service industry including: maintenance, construction, distribution, marketing, financial, legal, communications, cle[illegible]l, etc. These support functions, which now make up 70% of the GNP, help stabilise the economy because they remain in constant demand by a growing number of enterprises. (U.S. Department of Commerce Conference-1985).

The workplace in the U.S. also needs to change and is changing in many ways. It must become more competitive internationally. This requires more effective and efficient utilisation of its human resources. Lifelong retraining of the workforce is becoming a necessity. Management is having to rethink how it conducts its business. A new relationship is being formed between workers and employers, with more co-operative structures replacing the more adversarial. Participative management is becoming more and more common.

Yankelovich has identified three trends that have had an impact on the workplace. He notes that while the trends are not new, their combined impact is. These trends are:

1. Internationalisation of the U.S. economy. U.S. business has lost its comparative advantage in mass-produced manufactured goods, principally to Japan.
2. Rapid technological change. This has had the effect of increasing the amount of discretionary effort an individual brings to the job. In a series of studies that the Public Agenda Foundation did over the past five years on the workplace in the U.S. and Europe, it was found, "that the impact of technology on work did not denigrate jobs nor diminish enthusiasm and initiative. By more than 3 to 1, people experienced an increase in interest level (74% to 22%). Only 1 out of 5, those who were deskilled as a result of new technology, found greater monotony in their work. Thus, the first and second industrial revolutions had diametrically opposed effects: The first diminished the importance of the individual in the workplace. The current one, created by technology, has increased the importance of the individual."(Commerce Conference-1985).
3. "Emergence of new popular life philosophy and changing forms of expression. The least understood of the three trends, this "expressivism" is the wildcard in the deck. Most economists ignore it, yet cultural changes are fundamentally more important than economic and technological changes. This trend is changing the definition of success to money and standing plus lots of intangibles, most of which are unrelated to work--physical fitness, zest for fun, competition, adventure, experimentation in family life."(Commerce Conference-1985).

The Public Agenda Foundation found four attitudes toward work in surveys of U.S. workers (the percentage shown is the percent of workers expressing the attitude toward their work):

- An economic business transaction, 9%.
- An unpleasant necessity, 17% (this group does not have a work ethic in the sense of adding extra value to working).
- Interesting, but not to interfere with the rest of life (small limited commitment), 21%.
- To do the best job possible regardless of pay, 53%. This group shows a readiness to endow work with a broad range of meaning; this attitude correlates positively to the level of education.

Literacy requirements are affected by differences between the old and the new work ethic. In the new ethic, work becomes a form of self-expression. There has been a surge of individualism and autonomy in the workplace, exemplified by a winning-for-oneself attitude. The essence of autonomy and individualism is entrepreneurship, and this is currently experiencing a surprising resurgence.

The workplace has increased in importance---strategically, economically, socially. Human resources is the "hot" field as the competitive advantage in the U.S. shifts to people. The advantage depends on the will of the people and their ability to give more. It is not technology per se, but the commercialisation and translation of technology (fusion of people and technology) that will create a dynamic, new vitality in the American economy.

A new contract is emerging in the workplace, one that will correct today's limited commitment. Most people would rather have a bigger stake and give more (have psychological rewards). American management is just beginning to understand this, but is not sure how to deal with it. Because of the "trained incapacity" of management to deal with people issues, the transition will be very difficult. (Yankelovich, Commerce Conference, 1985).

Lifelong retraining is one of the most important implications of the emerging trends. This task could become a major industry.

D. The Changing View and Expectations of Labour:

In the U.S., successful companies consider the development of individual workers as an investment essential to productivity and to the economic well being of the organisation. U.S. industry has recognised that it cannot compete with "cheap" labour, only with "smart" labour. The gap between manager rewards and worker rewards must reflect the understanding that productivity comes from workers. The key to productivity lies in workers who have more discretion over their work, more responsibility for quality and a clear identity with their work.

Such a workforce must be highly literate. It must be able to learn new tasks as old jobs change and new jobs emerge, and also be creative, finding more effective and efficient ways of conducting the business of their enterprises. There are likely to be less and less opportunities for the low-literate in the U.S. workforce as automation takes over the low level and routine jobs. The importance of a literate workforce to the U.S. cannot be overestimated. (Commerce Conference, 1985).

People are viewed in the U.S. as the fundamental instrument of productivity.

> "The excellent companies treat the rank and file as the root source of quality and productivity gain." (Peters and Waterman, 1982, p.14).
> "Treat people as adults. Treat them as partners; treat them with dignity; treat them with respect. Treat them--not capital spending and automation--as the primary source of productivity gains." (Ibid, 1982, p.238).

E. The Changing Nature of Training

As the costs of training rise, traditional techniques are being called to account. Traditional, instructor-delivered training has been found to be needlessly labour intensive. Enterprises are developing training systems that do not depend on an instructor for live delivery, but rather elevate the position to that of a manager responsible for training results. For example, a large automobile manufacturer provides training to mechanics and sales personnel in dealerships across the country through interactive video-disc. Small manufacturing firms are producing and authoring their own video-disc training programmes and delivering certain parts of their training without instructors.

Micro-computers, video-discs and other interactive devices in the hands of creative trainers are increasing their productivity. Training is being "embedded" into the job itself, so that it is provided as and when needed. Training is only one part of an overall system of human development that will result in optimal growth and productivity for the individual and the organisation. Literacy is an essential ingredient of this system of human development.

Several trends are worthy of noting:

Trend No.1. Technology is being applied to the challenges of human development, both in the development and delivery of training in efforts to improve cost-effectiveness. There is evidence to dispel the myth that technology will dehumanise, indeed the opposite may be more accurate:

> "Man's use of mind is dependent upon his ability to develop and use "tools" or instruments or technologies that make it possible for him to express and amplify his powers....It was not a large-brained hominid that developed the technical-social life of the human; rather it was the tool-using, co-operative pattern that gradually changed man's morphology by favouring the survival of those who could link themselves with tool systems and disfavouring those who tried to go it on big jaws, heavy dentition, or superior weight. What evolved as a human nervous system was something, then, that required outside devices for expressing its potential.... Man is then dependent upon tools and technology for his very humanity." (Bruner, 1966, p. 25).

Trend No.2. A second trend seems to be toward a more systematic process to insure a rational approach to training. One such process has been referred to as a "systems approach" and includes the following elements:

- A clear description of goals and objectives is necessary as it provides the basis for:

  a) the initial specification of required resources
  b) the trade-off analysis of potential solutions
  c) the evaluation of performance.

- A clear definition of constraints is necessary because it establishes the conditions within which the system must function.
- The establishment of measures of effectiveness.
- The synthesis of alternate solutions. This consists of hypothesising different ways of achieving objectives within specified constraints, considering the problems of designing, fabricating, implementing, testing, evaluating, revising, and operating the system.
- The establishment of cost elements. All costs and their amortisation over the period of anticipated utilisation are considered. This provides a basis for comparisons between different approaches to achieving objectives.
- A cost versus effectiveness type of analysis in order to make trade-off decisions between possible solutions. The best possible training for the least cost is sought.
- The continuing process of evaluation after the system has been implemented provides the feedback (empirical evidence) required for modification of the system. The systems approach is not a sequential series of steps; it is a dynamic, iterative process; the entire system may be redesigned as a result of the operational evaluation. At every step of the way the results are analysed to verify or modify earlier decisions. (Barbee, 1972, p.4).

Trend No.3. A third trend is toward competency-based and individualised training. This is training for specific job tasks which is provided to the trainee at a time and in a form that permits each person to learn as efficiently as possible. The main characteristics of such training are:

1) The instructional programme is based on competencies specific to job requirements.
2) It describes both the system's and the trainee's responsibilities and "sets the stage" for learning.
3) The curriculum comprises carefully engineered learning experiences designed to develop specified competencies.
4) The learning environment, including the materials, are controlled by the trainee.
5) The skill or knowledge to be learned is presented to the trainee in a way that he understands.

6) It is interactive, i.e. it actively involves the trainee throughout the training.

7) It permits the trainee to practice the skill or internalise the knowledge under conditions approximating reality.

8) It provides opportunity for trainees to test themselves on the skills and knowledge taught.

9) It provides alternative learning strategies to meet the range of individual learning characteristics found in the trainee group(s). This normally requires a variety of media to satisfy such characteristics.

10) It measures performance and provides results to the trainee and to the instructor based upon specific job competencies.

11) It uses its results to improve itself, e.g. when trainees fail to achieve a competency within a reasonable time, the training system is examined to see what went wrong.

CHAPTER II

THE U.S. EXPERIENCE IN THE VOCATIONAL AND TECHNICAL TRAINING OF LOW-LITERATES

A. Factors Influencing the Low-Literate in the U.S.

U.S. training institutions, military and civilian, public and private, tend to "screen out" trainees with low aptitude (aptitude correlates with literacy).

- Literacy skills, if taught, are taught first, before technical training, thus increasing training time. This often causes trainees to drop out of the programme.
- Because of organisational requirements to place people in a job as soon as possible, basic skill development often suffers. For example, the fact that performance criteria for programmes funded under the Jobs Training Partnership Act emphasise job placement, more than job training and general employability education, seems to increase the chances that students will be screened for "aptitude" and counseled into training they can handle, with lower priority on overcoming educational deficiencies.
- Many basic skills programmes that are referred to as "functional" are often just traditional basic skills programmes with a few occupationally related words or mathematics problems. Neither literature review nor programme survey revealed a single instance of a totally integrated basic skills and technical training programme. (Sticht, et.al., 1985, pp. 5.10-11).

In the U.S. only limited attempts have been made to train individuals with low literacy by means not requiring literacy

There seem to be several reasons for this:

- jobs in the U.S. are requiring greater literacy.
- individuals lacking knowledge and literacy are severely restricted in terms of upward job mobility.

- workers with low literacy levels are not equipped to meet the requirements of the changing workplace and are more likely to be unemployed than their more literate colleagues.
- it is in the interest of U.S. society to break the poverty-illiteracy cycle through "intergenerational transfer of literacy." (Sticht, 1983)

Lack of intergenerational transfer of literacy. ". . . many students who enter our public schools come from homes in which they have been unable to acquire the minimal competencies needed to succeed in school; many of these students become dropouts and academic failures of the school system; they then become the unemployed and under-employed, lower socio-economic status, marginally literate parents of a new generation of students who, in their turn, will enter the schools without the minimum competencies needed to succeed, and the cycle of marginal literacy and marginal living will repeat itself." (Sticht, 1983)

There is strong evidence that a child's preschool language development is strongly dependent upon the parent's literacy and verbal skills, and if this is true, a child's literacy skill development in school is largely dependent on the verbal skills developed prior to schooling. Thus a major approach to improving children's literacy skills is to improve their parents' language skills, both oral and written.

A recent report that profiles the literacy skills and vocational knowledge of the Nation's youth (ages 18-23) shows that the mother's education level is one of the strongest correlates of achievement on the Armed Services Vocational Aptitude Battery (Profile of American Youth, Office of the Assistant Secretary of Defence; Manpower, Reserve Affairs, and Logistics, March 1982).

B. What Has Been Learned in the Training of Low-Literates ?

Literacy skill development facilitates technical skill development and technical skill development facilitates literacy, each assisting in the development of the other.

Much was learned in this area by the work in "Functional Context" technical and literacy training and reported by Sticht (1985) in "Cast-Off Youth". Research findings over many years support the assumptions upon which the functional context training is based, namely that:

- All new knowledge is acquired on the foundations of old knowledge. Hence, knowledge is both the beginning and outcome of learning.
- Knowledge can be used to learn new knowledge through "concrete" experiential learning, as in the early stages of the developmental model of literacy (see Annex I) and later through the "abstract" mediation of oral and written language. "Whole-to-part", or "familiar to unfamiliar" sequences of instruction can build on this developmental sequence, which can be replicated in presenting instruction to adults.
- Knowledge development can be focused on somewhat restricted domains of learning, as in job-related technical or literacy training, or on multiple domains such as in the grade school system. When time is limited, both technical and literacy training for work can be most expeditiously accomplished using knowledge (including processes) objectives closely related to the requirements of jobs.

- Knowledge development requires active information processing by learners and, for maximum transfer from training to the next environment, information processing should use the contexts, tasks, procedures, and materials of the future, in the present training environment. The best way to prepare the cognitive system for the future is to practice the future in the present. Obviously, to the extent the future is unknown, education and training cannot maximise transfer.

- Knowledge is used both to process information and to comprehend it. Thus, for instance, "reading comprehension" can be improved by improving knowledge in the domain or domains to be read. This is what education in the various content or discipline areas accomplishes (among other things)." (Sticht, 1985. p. 3.65)

It seems likely that programmes developed to teach both literacy and technical skills building one upon the other following these principles are more likely to meet the objectives than those not following this guidance. This is well grounded in research findings over many years and seems a good place to start.

> Building upon the knowledge and interests of the adult, literacy skills can be raised to a functional employment level. These skills and job knowledge can then be used to acquire higher levels of both job related and general literacy.

> In the U.S. there is reluctance to make a commitment to such development. This appears to reflect economic conceptions of human resources development that place a cost/benefit utility on education. Twelve years of public schooling are allocated to the development of people, who are then available for the work force. In this approach, schools develop people, and employers utilise people. If, for instance, a person does not acquire fifth grade reading skills in the fifth grade, then, as an adult, the person is not to be developed but "remediated". The remediation should be done as quickly as possible so the person can be utilized productively.
>
> The problem (with this perspective) . . . is that many adults need a long-term period of development. However, they also need to be productively employed while they are developing."(Sticht, 1983, p.15)

"When vocational literacy training incorporates job-related reading tasks, students may perceive a functional use for literacy and will frequently be motivated to learn to read when traditional, "general" literacy programmes fail to engage them. (cf., Sticht, 1975b, for an example of a job-related reading programme; Diehl & Mikulecky, 1980 have replicated many of these findings in an analysis of some 100 civilian occupations). (Sticht, 1983, p.27),

Functional Context Literacy and Technical Training needs to be encouraged in every enterprise, organisation, agency or other entity that employs personnel. Only in this way can this training be provided in a cost-effective and feasible manner. "Packaged" programmes already exist that could be adapted to almost any organisation. These programmes at present do not incorporate the technical training and would need to be adapted using "functional context" training guidelines to meet various local needs.

In such enterprises, it is necessary to focus on the mission of the organisation, focusing the development of its human resources toward organisation goals. This presents a slightly different challenge as Sticht points out:

"When one focuses not on improving individuals but on improving organisations, one develops perspectives that are different than in considering human resources development as general education. In organisations that deal primarily with the utilisation of human resources, such as any number of businesses or industries, the Department of Defense, or other government agencies, human resources development does not have as its goal the improving of the individual's skill and capability, per se. Rather, the purpose is to improve organisational effectiveness in performing its functions. The improvement of individual capability is undertaken as a means to organisational ends, not as an end in itself." (Sticht, 1983, pp. 15-16)

"Redesigning job materials to give less literate people access to productive work makes it unnecessary to screen them out. From the organisational point of view, this improves recruitment by expanding the size of the work force available. This approach gives people an opportunity to work, plus access to a developmental system that permits them not only to perform an entry level job, but to develop the basic literacy and learning skills needed to proceed to a higher level job." (Sticht, 1983, p.17)

"Poor readers do not make up for their lack of reading skill by an increased use of auding, they simply operate with less job-relevant information. There are also indications that when personnel develop their reading skills they tend to seek additional information by reading, not auding". (Ibid, p.21)

Sometimes a lower level of literacy may be tolerated for some jobs even though the job tasks require a higher literacy level. There are two basic types of job reading tasks: "reading-to-do", in which information is looked up in order to do some task at hand, and then may be forgotten; and "reading-to-learn", where the information read is "learned" for later use. Sticht points out that the requirements for each of these are often quite different with some reading-to-learn tasks requiring high levels of literacy, although this was not always the case.

"It is perhaps because of the repetitive, homogeneous nature of job tasks and job reading tasks that the effects of lower levels of literacy, and, conversely, the relatively high levels of reading difficulty of materials in military and civilian jobs (Sticht and Zapf, 1976; Mikulecky, 1981) can be tolerated.

Personnel have repeated opportunities for gaining experience in performing job tasks, including the reading and rereading of materials used in support of the job task." (Sticht, 1983, p. 24)

Programmes that individualise the instruction and encourage self-directed learning tend to produce greater learning gains in less time than their traditional counterparts. A pilot study conducted in adult basic education (ABE) classes using Keller's Personalized System of Instruction (PSI) materials, (Cox and Lane, 1981) found that students working with individualised material oriented to their specific needs accomplished more work than classmates. Although this study suffered from major methodological problems, the trends were clear. A considerable body of research examining the connection between academic achievement or engaged time and student perception of efficacy or control (e.g. Thomas, 1980, Stipek and Weisz, 1981) supports the contention that individualised instruction offers the best conditions for learning, particularly for adults.

Studies of Job Corps programmes over more than 20 years have shown substantial success with individualised training. (See Case Study 6 of this Report).

Often job training programmes require higher levels of literacy than the jobs themselves. (Sticht, 1983, p.27). To avoid this problem the literacy requirements of the job must be carefully analysed and training programmes adjusted so that a job-relevant level of literacy and knowledge is provided to insure acceptable performance of technical skills. This must include reading-to-learn skills appropriate to the job.

The literacy requirements of jobs in the U.S. are increasing. A number of researchers and practitioners in the U.S. have made this observation. Most occupations require a high level of basic skills, i.e., 10th to 12th grade levels, although the applications of these skills may be diverse. The workplace requires not only the ability to read, write, and compute, but also the ability to use these skills in problem-solving on the job. Jobs that require only low literacy are generally "dead end" in nature, and even many of these jobs will require increasing levels of literacy in the future. There is growing evidence that not only are the literacy requirements of jobs increasing, but their application in the working environment is broadening and deepening. (Stich and Mikulecky, 1984)

Adult learners differ in important ways from children. Of particular significance is the assumption that adults have experience and motivation to support their learning activities, and the possible handicap of attitudes shaped by experiences of academic or economic failure. This can limit the effectiveness of strategies which work for homogeneous groups of children. One attitude that may plague students is that their effort is unrelated to achievement, or that achievement is unrelated to success. Critical to academic success is the belief that one's work will lead to achievement. Some students, especially the disadvantaged or minority trainee, may not enter the training system with this belief, and their schooling or experience may be such that they may never believe it. Individualised, self-directed learning environments capitalise on the fact that students who feel in control of their environment, who experience the connection between their academic activities and their achievement, will be more efficient and productive learners. (Berlin, 1984)

Other findings of value in the training of the low-literate:

- There is a relationship between the basic skills levels of workers and job performance, but the relationship is by no means overwhelming or direct.
- There is evidence that employers are taking a larger role in providing basic skills training for their employees; however, they are more likely to be training employees in job-specific literacy skills.
- It is possible to make fairly rapid gains in ability to comprehend technical material if literacy training is focused on that material.
- General literacy improvement is not a noticeable result of job-related basic skills training unless there is sufficient time spent (i.e., 5 hours per week) using appropriate general materials.

C. What methods and techniques have been developed in the U.S. to train the low-literate?

Andragogy (Ingalls, 1983) is a process for adult learning based on four primary assumptions, drawn from experience with adult learners;

- Adult learners are usually self-directed. They attend because they want to for their own reasons, not, as children do, because the law requires it.
- Adult learners have a broad base of experience to act as a context for learning. New learning builds on previous learning and experience.
- Adult learners have felt the constraints on their ability to perform in social roles brought about by their lack of basic skills. They are motivated in part by a desire to enter more fully into social life.
- Adult learners have, in general, a problem-oriented approach to learning. They come to class with a problem they think can be solved by improving their skills.

In the Andragogical process, the development, organisation, and administration of programmes involve continuous circular application of the following seven steps:

- Setting a climate for learning
- Establishing a structure for mutual planning
- Assessing interest, needs and values
- Formulating objectives
- Designing learning activities
- Implementing learning activities
- Evaluating results (reassessing needs, interests and values).

An Inventory Tool for Job Analysts in Reading Task Identification

In research for the Navy, an inventory tool was developed that job analysts could use to (1) identify the reading tasks people perform in various jobs, (2) determine the percentage of people reading at different skill levels (expressed in reading grade levels as determined by a standardised reading test) who could be expected to

accurately perform the job reading tasks, and (3) estimate the level of reading skill needed to achieve management goals for job proficiency and performance (Sticht et. al., 1976). The report presents a detailed discussion of the methodology and a critique of several different methods for estimating the reading requirements of jobs.

To identify the reading demands of any Navy job, using this inventory approach, one would first administer the inventory to determine the frequency and importance of each reading task. Then, to determine the reading grade-level of difficulty for each type of reading task in the inventory, the job analyst would consult an expectancy table which showed how well people of different reading grade-levels performed. At this point, a decision would be made about what percentage of people should be able to perform the reading tasks.

To determine the reading difficulty of a job, the reading grade-level of each reading task would be weighted by its frequency and importance. These weighted figures would be summed, and the average reading difficulty level would be computed. The resulting average would be the level of general reading skill needed to perform a given job (Sticht, 1983). (A description of the application of this approach to the design of job-related literacy programmes for the military services may be found in Case Study 3, The Development of Two Job-Related Literacy Programmes).

Functional Context Instruction (Sticht, 1985) was developed from a long series of research findings both in and out of the military and incorporates the U.S. Department of Labor's Job Corps experience, "Project 100,000" findings, as well as the findings from other studies, and it employs a developmental model of literacy (see Annex I).

Before, during, and after Project 100,000 (see Case Study 1), military human resource research laboratories conducted two lines of research and development that explored new methods of training.

A distinctive characteristic of these lines of research is that they focused on the redesign of entire training programmes.

One line of research pursued the redesign of technical training courses, while the other explored new approaches to literacy training. Eventually, however, following Project 100,000, the two strands of research were brought together to finally pursue the one recommendation of the Project 100,000 management that had not been previously accomplished: the identification of literacy requirements of job training programmes and the integration of literacy training with job technical training.

The Functional Context Concept. Both the technical and literacy training research pursued by the military laboratories were conducted under a more-or-less loosely conceived idea called "functional" training. Within the sphere of technical training, the concept was dubbed the "functional context method" by Shoemaker (1960). Within the sphere of literacy training, World War II educators and trainers had referred to the programmes of literacy training offered in the Special Training Units as "functional" literacy training (Goldberg, 1951).

Preceding both the World War II literacy programmes and the post-World War II technical training studies in the military, the principles of functional education and training were presented in a book called School Administration by Fox, Bish, and Fuffner (circa 1920). Briefly, these principles included: to relate new instruction to old; to make curriculum practical by justifying topics and applying theory; to focus on purpose by providing immediate and explicit objectives; to assist learning by creating a hands-on environment; to teach support topics only as needed and, where appropriate, using actual equipment; to limit memorisation by associating topics with practical applications; and to organise units of study into meaningful subunits organised around a whole.

To be "functional", therefore, instruction should build new knowledge on old knowledge, should be meaningful in terms of the learner's knowledge, as well as meaningful in terms of the learner's knowing both what is to be learned and why. Learning should be facilitated by limiting memorisation and, instead, relying on understanding by presenting a whole-to-part organisation of learning units, more easily recalled through practical applications.

The Comprehensive Competencies Programme (CCP, 1983-1986). CCP delivers indidivualised basic skills instruction to both youth and adults requiring it, and can be adapted to almost any instructional setting. CCP has integrated a number of programmes, approaches and materials developed over the last several decades, that had been individually shown to be effective in producing learning, into a system which can be implemented and operated cost-effectively in diverse settings to deliver individualised, competency-based instruction using state-of-the-art educational technologies. The learning system covers academic competencies--ranging from elementary reading and arithmetic, through high school and introductory college-level science, math, humanities, social studies and writing. In addition, it includes basic, intermediate and advanced functional competencies in occupational knowledge, consumer economics, government and law, health and use of community resources.

To diagnose learning needs and to track competency attainment, the CCP includes 750 Mastery Tests. Initial Locator Tests indicate whether beginning skills are basic, intermediate or advanced. Subject Strand and Tier Mastery Tests assess global competency. More focused Level Mastery Tests measure the skills covered by included Units, while short Unit Mastery Tests assess mastery of the very specific Lesson objectives within each Unit. Using these tests, each learner can be simply and quickly assigned to instruction of appropriate difficulty in just those subject areas which have not been mastered. Each learner's progress through the hierarchy of competencies is documented by the results on the associated mastery tests, while the results for all learners reflect the output of the instructional programme and staff.

For every detailed Lesson objective, the CCP provides Lesson Assignments referencing an array of print, audio-visual and computer-based learning materials identified through an exhaustive review of commercial and public sector courseware. The user has flexibility to incorporate any other preferred materials. Hundreds of individual and group exercises, as well as experienced-based learning activities, are included with the CCP as supplements to referenced materials.

The CCP Information System minimises the paperwork and time required for planning and assigning lessons on an individualised basis, as well as for tracking each learner's progress through the assignments and tests. Automated test-scoring, lesson assignments and recordkeeping, as well as reporting, analysis, management and communication are possible using an inexpensive Apple IIe computer.

Finally, the CCP includes reference manuals and user guides, plus an individualised and self-paced staff training programme supplemented by video-tapes and structured training activities. CCP instructors are trained and certified to provide technical assistance to users. With this help, it is possible for organisations with little or no basic skills instructional experience to implement and operate effective programmes. All users are networked through quarterly bulletins and updates. Annual monitoring plus quarterly reporting and annual planning help to identify and correct problems. The comprehensive data which are collected quarterly from each user are analysed to assess CCP and user effectiveness. The results are applied to refine the CCP annually as well as to improve user performance from year to year.

D. What new technologies hold promise for the training of low-literates?

The micro-computer, already being used for management and instruction with extraordinary success in CCP and other basic education programmes has decided potential as a tool for further "individualising" instruction. With proper software this tool permits trainee control of the lessons, a variety of learning strategies, branching, color graphics of good quality, even

digitised audio. Most software is infinitely patient, highly reinforcing, and adaptable to learner requirements. Authoring systems that do not require knowledge of a computer language are available to permit trainers and curriculum developers to construct their own lessons or adapt existing materials to their local needs.

The range of micro-computer software in basic education is growing and most is available in Apple and IBM-PC formats, as well as Commodore and others. The cost of the micro-computer is coming down at the same time that its power and flexibility are increasing. New training programmes should definitely consider using this tool, and established programmes may wish to look at its potential for improving their cost effectiveness.

The Interactive Video-disc is one of the more promising technologies now available to vocational, technical and basic skills training. Under the control of a micro-computer the 54,000 pictures available on each side of the 12" disc are randomly accessible in whatever branched sequence the trainer or curriculum developer wishes to programme. Recent authoring systems, like those designed for the micro-computer, require no knowledge of a computer language and permit the programme developer to put together a tailored programme. Since the "programme" is contained in the computer and not on the video-disc, the same video-disc can be programmed for a variety of purposes and learning requirements. This has significant cost implications as existing video-discs available from an ever growing number of producers may be adapted for a variety of uses. This "archival" use of the disc has substantial potential for foreign application as the printed language that appears on the screen comes principally from the computer and therefore can be readily changed. The video-disc itself has two sound tracks and, with recent developments, several seconds of sound may be stored in place of one of the 54,000 video frames. Mosts discs currently available, however, have about 30 minutes of sound in each of two tracks which are activated when the full motion capability of the video-disc is being used (running at a speed of 30 frames/second which is the NTSC Television standard in the U.S.).

Supplementary audio, randomly accessible video-tape, and other "peripherals" may also be easily added to the basic micro-computer--video-disc combination. Language can be changed on the computer and even audio may be "translated" to meet local requirements. Thus a disc that was developed in the U.S. to teach welding could be adapted for use in Peru or Thailand with relative ease.

The Interactive Video-disc has all of the attributes for instructional management and delivery that the micro-computer has (as it contains one), plus it has full colour photographs, as still frames or motion, available to the instructional developer on call with a maximum search time of about 2 1/2 seconds. As increasing numbers of discs become available in basic skills education and training, serious consideration should be given to this rapidly emerging training tool.

Compact Disc and Optical Disc--Read-Only-Memory (CD and OD-ROM). One of the newest and perhaps the most promising tool thus far developed is the Compact Disc. Only 5 1/2" in diameter it can store 600 megabytes of information (the equivalent of three sets of encyclopedias) or high quality audio (its main commercial application at present). The optical disc can store pictures. Like the Video-disc, the CD-ROM is directed by a computer. Trainees using this tool would have access on one disc to the equivalent of about six of the larger computerised data bases available in the world today (The U.S. Library of Congress would be a notable exception).

CHAPTER III

GUIDELINES FOR THE DEVELOPMENT OF A SYSTEM FOR THE VOCATIONAL-TECHNICAL TRAINING OF LOW-LITERATES

What can be learned from the U.S. experience in the training of low-literates that is applicable to the developing world?

A caution

The U.S. has few truly illiterate people, probably less than 1%. Most people in the country are able to read at a fifth grade level or above and perform basic mathematical calculations. Our society is filled with opportunities to gain knowledge that is, of course, the content of literacy. Beginning as children, most of our society are exposed to the written word and numbers, and most of us learn to value literacy. Education is generally valued. We do, however, have a number of individuals in our society who are marginally literate, those who read at a 5th to 7th grade level. Unfortunately, this does not really equip them for many of today's jobs that require from 10th-12th grade reading levels, nor for day to day life in our society with its increasing requirements for literacy. To the extent that another country has conditions for literacy similar to ours and a similar culture, our findings in studying the training of low-literates may be applicable. It is likely that most nations are not like us, and will need to interpret these findings for themselves adapting this guidance to their varying conditions.

Programme Development Guidelines

Guideline No. 1.

Literacy training should be built into vocational and technical skills training.

Literacy and knowledge go together. Literacy cannot be taught without building on existing knowledge and it seems reasonable to use job knowledge as the content of further literacy development for adults. The research in "functional context" and other competency-based and individualised training clearly bears this out. It seems likely that this would also hold true in most societies. This would mean that in planning vocational and technical skills training programmes a literacy component should be built in using "functional context" principles. (See later Guidelines and the full Report for more specific guidance).

Guideline No. 2.

Literacy development should be "encouraged" throughout each person's life. This should be done through parental literacy training as a part of the parent's on-the-job training, as a part of formal education, in each person's preparation for a vocation and through on-the-job and other training and educational experiences throughout their lives.

Literacy is developmental, beginning in infancy and continuing throughout a person's life. It begins with the infant naming his or her world, and when encouraged formally and informally, simply becomes a part of the learner's "tool kit" for further learning. More formal literacy development should then accompany all training and education in which individuals engage throughout their lifetimes. This would seem particularly important to countries without a long literacy tradition.

Guideline No.3.

The training of the Low-Literate should be competency-based and individualised providing for self-direction and learner control.

The evidence is clear that the low-literate can achieve job competency when provided with learning opportunities that:

- are actually based on the competencies required in doing the job;
- let the trainee know what to expect, i.e. describe both the programme's and the trainee's responsibilities and "set the stage" for learning;
- let the trainee know what is to be learned in a way that he or she can understand the purpose of the training;
- are made up of carefully designed learning experiences that have been tested and have been shown to develop the job competencies in the trainees for whom they were designed;
- let the trainee control the learning;
- let the trainee have the skill or knowledge to be learned presented in a way that they understand;
- are "interactive", i.e. actively involve the trainee throughout the training;
- provide opportunity for the trainee to practice the skill or internalise the knowledge;

- provide opportunity for the trainee to actually perform the skill or use the knowledge under conditions that closely resemble the real job conditions;
- let the trainees test themselves on the skills and knowledge to be learned;
- provide alternative learning activities to better serve the individual learning needs of the trainees, to ensure that each trainee attains mastery of each competency;
- track the progress of the trainees and measure their performance throughout the programme. This information is provided to both the trainee and the instructor; and finally that
- use the results to improve itself, i.e. if trainees do not learn, then the programme is examined to see what went wrong.*

Guideline No. 4.

Explore the possibility of using existing programmes before designing a completely new one.

There are a number of "good", well designed programmes for teaching functional and academic literacy to the low-literate that could be adapted for use in most countries to their vocational and technical training or basic education programmes. Several have been described in this Report. The Job Corps, Functional Context Training programmes, and the CCP are outstanding examples. If you are considering utilising U.S. programmes, the U.S. Department of Labor's Center for Advanced Learning Systems can provide information and technical assistance, or you could contact the particular programmes directly.

Guideline No. 5.

Develop your training programmes for the "Low-Literate" as a part of the larger system of human resource development and within the context of the overall development of your country.

This requires the utilisation of a systematic planning process which should comprise the following:

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*The foregoing was adapted from "The Characteristics of a CBIM Learning System," developed by David E. Barbee for the U.S. Department of Labor's, Center for Advanced Learning Systems, 1983.

- Clearly defined objectives and goals to identify initial resources required, permit a trade-off analysis of potential solutions and provide the basis for evaluation of performance.
- Clearly defined constraints.
- Measures of effectiveness.
- Hypothesis of different approaches to objectives.
- Identification of costs as well as an amortisation schedule to permit cost/benefit analyses of alternative solutions.
- Continuing evaluation process; results analysed at every step to verify or modify earlier decisions.

Guideline No. 6.

Don't be afraid to consider using the new tools spawned by the micro-electronic revolution and the new age of information such as the micro-computer and video disc.

Careful analysis will reveal what is appropriate for your particular requirements. In conducting your analyses be sure to include all of the current costs of operating your system per unit of output. Training programmes that do not really prepare the low-literate for employment can be very costly, on the other hand some apparently "high cost" programmes that produce "high output" can be quite cost-effective. An example is the CCP that is described in Case Study 6 of this Report. They could not produce the learning gains nor manage their programmes without the micro-computer and appropriate software.

Guideline No. 7.

Think of the development of the "low-literate" in your country as an investment that might yield a very high return.

Do an analysis to see what your return would be in terms of taxes returned, welfare that need not be paid, or perhaps even saving the costs of prison or other institutionalisation. Studies in the U.S. show that the return is high.

Guideline No. 8.

Government, business, schools, universities, training organisations and other groups all have a part to play in the preparation of the low-literate for productive employment in our societies.

To train the low-literate in society for full employment provides social, political and economic benefits to society. This is not always understood, nor believed. The benefits of this human development to society must be made known in very specific terms on a continuing basis. Business can hire the low-literate in entry level jobs that they can do, redesigning written materials and other impediments to their success, then provide training that integrates literacy and technical skills development using their existing knowledge as a starting point. Keeping the person employed provides benefits to both the employer and the employee.

Schools and training institutions can implement more functionally related and integrated programmes in their basic education and training. Universities can assist through continuing research and preparing human resource development professionals with appropriate sensitivities and skills in working with low-literates. Government can encourage the integrated development of literacy and technical skills programmes through legislation, including tax incentives and assistance to encourage schools, organisations and businesses to recognise the opportunity and capitalise on this undeveloped source of human capital, the low-literate in our society.

CHAPTER IV

CASE STUDIES THAT EXEMPLIFY THE U.S. EXPERIENCE IN THE TRAINING OF THE LOW-LITERATE

CASE STUDIES NOS. 1 AND 2 - EXTRACTED FROM "PROJECT 100,000" AND "CAST-OFF YOUTH" (Draft Report: Sticht, et al., 1985)

Perhaps the largest project in history to interrupt the cycle of poverty in this country was undertaken from 1966 to 1971. In Project 100,000 as it was named, up to 100,000 youth per year who were previously excluded from military service because of their low performance on military aptitude tests, were admitted into the armed services.

Project 100,000 initiated research and development projects to summarise what was known about effective methods for training low-literate personnel, to implement these methods and to develop new approaches for training the full spectrum of aptitudes.

A study of Cast-Off Youth completed in September 1985 for the Ford Foundation by Sticht, Armstrong, Hickey and Caylor, et al. studied both Department of Defence data bases concerned with the overall management and evaluation of Project 100,000 personnel and the extensive and frequently difficult to locate research and operational reports on the training approaches and methods the military utilised to successfully meet the learning needs of Project 100,000 "new standards" recruits, as they were called.

A. Activity 1 - Employing the Unemployable. This activity studied the military's experience in employing personnel whose mental aptitude scores were lower than military standards would ordinarily permit. Relevant findings from this activity for purposes of this report include:

- lower aptitude personnel had somewhat higher attrition rates, lower levels of job proficiency and achieved less rank than higher aptitude personnel. However, the differences were small and when compared to average aptitude groups the low aptitude service members achieved 80% to 100% as well on these various indicators of performance.

- In 1983 some 8,200 Project 100,000 personnel had achieved career status in the military and were still on active duty. As a group, their years of education were up, their aptitude scores had increased and they were working in middle-management and supervisory roles in a set of occupations of higher cognitive demands than those characteristic of the job assignment of Project 100,000 personnel as a group.

- As civilians, Project 100,000 veterans compared to a non-veteran control group of similar background were found to have earned more per hour, have less unemployment, achieved more education and have higher enrolments in education or training programmes.

B. Activity 2 - Training for Cast-Off Youth. This activity, reviewed training guidance, procedures and research by the military aimed especially at educating and training less literate, lower aptitude personnel. The focus of the effort was on how to adapt training contents and methods to the needs of lower aptitude personnel. This review produced the Functional Context Approach as a conceptual framework for education and training curriculum development that integrates research from cognitive science with the training research of the military.

Five principles for the revision or design of instruction to adapt it to the Project 100,000 personnel were recommended by Project 100,000 management, these included:

- Relate initial instruction to what the person already knows.

- Identify probable areas of learning difficulty for Category IV (low aptitude) personnel and revise these areas.

- Integrate literacy training into technical training.

- Relate learning situations and methods to specific military situations.

- Design specific course objectives that are job-related.

Research related to the Project 100,000 training design guidance was reviewed with special attention to a body of research on functional context training. This research included seven major projects to develop functional context technical training and four major projects to develop functional context literacy training:

- Functional Context Technical Training. All of these projects aimed at implementing four of the five recommendations of the Project 100,000 management, with the one exception being the recommendation to integrate literacy with technical training. Without exception, the seven projects produced courses superior to the conventional courses with special emphasis on the needs of average or lower aptitude learners.

- Functional Context Literacy Training. Repeatedly, studies in the military have indicated that brief, remedial programmes of general literacy training make only minimal, if any, real improvements in students' literacy skills. Where significant improvements in useful competence have been demonstrated, say in performing military-life reading tasks, rather than showing grade level gains of general reading tests, the instruction has not been academically-oriented but rather the contents, materials and tasks have been developed to incorporate the functional concepts and practices of military life, training and job requirements. This has been true from World War II to the present.

Discussion. The major legacy of Project 100,000 for training and education is a set of principles, with partially worked-out examples illustrating how to apply the principles for the design of instruction. We have called this set of principles the Functional Context Approach. In applying this approach to instructional development, one provides a functional context that facilitates learning in the course and transfer to settings outside the course.

To facilitate learning, functional context programmes:

(1) Let students know what they are to learn and why in such a way that they can understand the purpose of the training or education programme.

(2) Develop new knowledge on the basis of old knowledge that the student has on entry into the programme.

(3) Develop new lessons on the basis of old lessons so that the new learning builds on prior knowledge.

(4) Integrate instruction in skills such as reading, writing and arithmetic into the technical training or academic content area course to permit students to better relate the requirements for these skills to other settings.

To facilitate transfer, functional context programmes:

(5) Derive objectives from an analysis of the knowledge and skills demands of the situations for which the course is supposed to be providing human resources.

(6) Utilise, to the extent feasible, contexts, tasks, materials and procedures in the course taken from the setting that training and education address.

"These six principles, so commonsense in concept are so frequently abused in practice, that they might well be used by programme developers as checklists for guiding programme design and by programme evaluators for judging the adequacy of education and training programmes, particularly for youth cast-off from the mainstream of education and employment".

C. Activity 3 - An Electronics Technician's Functional Context Course.

This course was designed to prepare low aptitude students for success in the electronics technology courses typically given in vocational education programmes and was designed using functional context principles. A five-phased approach was employed in the design of this course.

In accomplishing Phase I, research on functional context training was reviewed along with research from the cognitive sciences bearing on the knowledge and skill needs of electronics technicians. Phase II included a survey of civilian programmes serving youth similar to those of Project 100,000 and electronics industries and employment agencies. Phase III consisted of the design, development and tryout of a prototype course that integrates basic skills and basic electricity and electronics training. Phases IV and V were briefly discussed as future activities. Major findings from each phase of activity of particular relevance to this report include:

Phase I

- Basic skills are inter-related capabilities that draw upon a common knowledge base in an individuals' cognitive system. Hence, improvements in basic skills can be accomplished by improving students' knowledge in a domain area; this knowledge can then be used by the basic skills. The application of basic skills in a particular domain, electronics training in the present case, strengthens these skills. This integration of the human cognitive system explains, at the level of cognitive science, why technical training and basic skills training can be integrated in instructional practice.

Phase II

- As in the military, civilian organisations tend to sort people into training programmes (and hence, careers) for which their basic skills render them suited.

- As in the military, civilian organisations tend to teach basic skills as prerequisite, front-loaded programmes for entry into technical training, thus lengthening the individual's training pipeline, in some cases leading to drop-out from training.

- As in the military, organisational requirements tend to drive educational practice. Performance criteria for programmes funded under the Jobs Training Partnership Act emphasise job placement, more than job training and general employability education. Thus students are likely to be screened for aptitude and counselled into training they can handle, with lower priority on overcoming educational deficiencies.

- As in the military, many basic skills programmes that are referred to as functional are often just traditional basic skills programmes with a few occupationally related words or mathematics problems embedded in them. Perfectly integrated basic skills and technical training programmes are extremely rare.

Phase III

- A tryout of an early prototype indicated that: Students were able to learn BE&E (Basic Electricity and Electronics) and mathematics concepts in the functional context of analysing and trouble-shooting electrical devices. All of the students preferred learning mathematics in the functional context class rather than in an ongoing, front-loaded mathematics course used to prepare students for entry into a BE&E course.

The study authors then noted that:

- The Functional Context Training Electronics Technicians Course provides, to our knowledge, a first instance of an attempt to develop a fully integrated basic skills and technical training programme in either a military or civilian setting.

And finally they noted that their literature search revealed very little systematic research underway today to address the pressing problems of youth unemployment and unemployability through changes in curriculum and instruction.

CASE STUDY NO. 3 - EXTRACTED FROM "THE DEVELOPMENT OF TWO JOB-RELATED LITERACY PROGRAMMES"

(Reprinted from: Sticht, HumRRO PP 2-83, 1983, pp. 35-44)

Two projects attempted to relate job and literacy skills training. One project, conducted for the Army (Sticht, 1975b), produced a 6-week job-oriented literacy training programme to be given after basic military training and before job technical skills training. A second project, conducted for the Air Force, produced a job-oriented programme for personnel at their duty station (Huff et al., 1977). Job incumbents attended this programme for two hours a day to prepare them for performing job reading tasks and correspondence course training more effectively.

Both the Army and the Air Force programmes use materials and content taken directly from job skills training programmes and from job manuals and other job performance aids. Instruction in reading and learning of these materials is presented in both programmes by means of two curriculum strands:

A. Strand I - Reading-to-Do. This strand provides extensive drill and practice in fact finding and following directions in job reading materials. The Army programme provides practice in six modules: using tables of contents, indexes and tables and graphs; looking-up information in the body of a manual; following procedural directions; and filling out job forms. The Air Force programme, being aimed at a somewhat higher level reader, omits the practice in using tables of contents and indexes. In the remaining four modules, it provides training similar to the Army programme. It should be recalled that the actual materials and content differ in the two programmes and are taken from job reading materials used in the particular Service.

   The reading-to-do strand provides extensive practice in applying whatever reading skills a person has to the performance of fact finding and following directions tasks involving the types of materials the person will encounter in job skills training or on-the-job.

B. Strand II - Reading-to-Learn. The reading-to-learn strand contrasts with the reading-to-do strand in being concerned with the processing of information for future use. Hence it emphasises the development of strategies for learning from written texts. To process information for learning, people must be prepared in at least two ways; they must have a knowledge base which they can bring to bear in comprehending the material to be learned and they must possess skills for studying materials and relating what they read to what they already know.

The reading-to-learn curriculum includes specially developed materials to promote the acquisition of a relevant knowledge base which would help literacy students learn better from their job training materials. These materials are written at a lower difficulty level than those encountered in job training and incorporate the basic concepts and topics within a given job career field.

Evaluation of the Job-Related Reading Programmes

Several approaches were used to evaluate the effectiveness of the job-related reading programmes. For both the Army and Air Force programmes, summative evaluation data were obtained by pre- and post-programme tests of general reading and job-related reading. Formative evaluation data were obtained from the pre- and post-module proficiency tests of the Strand I reading-to-do programme. Formative data for the reading-to-learn strand were obtained for Army personnel in a small-scale study in which specially constructed representation transformation tests were administered pre- and post-training in the reading-to-learn activities.

In addition to the direct evaluation of training effectiveness, the Army programme was further evaluated by comparing the summative pre- and post-training general and job-related reading test data with such data obtained by a group of Army personnel in technical training who had received no literacy training and with similar data obtained by Army and Air Force literacy students in programmes teaching only general literacy, not job-related literacy.

Finally, in addition to the test score data, questionnaires were used to obtain information from Army and Air Force students on their perceptions of the value of the job-related literacy training in improving their literacy skills and from Air Force supervisors about their perceptions of the effects of literacy training on Air Force students.

Summative Reading Improvement Data for Students in Army and Air Force Job-Related Programmes

	General Reading*		Job-Related Reading*	
Test Score	Army	Air Force	Army	Air Force
Entry	5.3	9.2	5.2	10.2
Exit	6.0	9.7	7.3	11.3
Gain	0.7	0.5	2.1	1.1
N	714	93	714	93

* Scores are expressed in reading grade levels.

In both programmes, job reading gain was much larger than general reading. This is important because it indicates that people are learning what they are being taught. In many evaluation studies, standardised reading tests are used to evaluate programmes, with no good rationale as to why it is believed the test scores should change. Usually, there is no demonstration that the standardised tests reflect what is being taught. Clearly the present results show that reading is not altogether a generic skill, assessable by any test or general reading.

The job reading task test results show that specific literacy skills can be developed and assessed for generalisability in the domain area which corresponds to what was taught. The latter point is demonstrated by the fact that performance on-the-job reading task tests improved even though the specific content and questions asked were not included in any training module.

These data suggest that, although students with high levels of reading skills are able to perform job reading tasks well, it is not necessary to develop high levels of general literacy in job-related reading tasks. The latter are most efficiently taught by direct instruction in performing such tasks.

Thus, the results of module tests, pre- and post-summative tests and end-of-course and follow-up questionnaires indicate that improvements in job reading skills resulted from participation in the functional literacy programmes. This indicates that it is feasible to integrate literacy and job skills technical training, at least in terms of content.

Institutionalising the Job-Related Reading Approach

Though successful in demonstrating that job-related literacy training is more efficient than general literacy programmes in improving the ability of personnel to perform job reading tasks, the job literacy training research also indicated that, even with literacy training focused directly on job-related reading, many personnel achieved only modest gains in skills, while others did not improve, at least to any measurable extent. Thus it seems likely that, for those who enter the services with very low levels of literacy, the achievement of large, long-lasting improvements in literacy skills will require a long-lasting development effort.

As reported by Sticht et al. (1976) in the Navy research, a long-lasting development effort would have to involve a greater degree of co-operation and inter-relatedness, at policy and content levels, of the military's counselling, educational and job technical skills sub-systems. This could permit a continuing programme of development for less literate personnel that relates to the requirements for literacy in the initial environment encountered upon entry into the service, during technical skills training and at the duty station.

The U.S. military is undertaking an extensive set of activities to produce a more effective literacy development component of the human resources acquisition, development and utilisation systems in these services. Policy guidance has been issued and projects are under way to develop job-related literacy training. Now additional work is needed on methods for system integration: methods for more completely integrating job technical training and literacy training so that personnel are not sent away to what is too often referred to as "dummy" school; methods for counselling and scheduling to

ensure that personnel who enter at low levels of literacy skill are successively enrolled in each level of literacy training; methods for measuring and indexing continuous development in literacy and learning strategies that go beyond the reading grade level scale which is simply unsuitable for indexing increments of job-related literacy in adults; and methods for articulating job-related literacy training and development of skills for coping with military life with high school completion requirements, so that both the military's competence and the person's credentials requirements for promotion to higher ranks and levels of responsibility can be met.

Applications to Civilian Settings

There are today the beginnings of a transfer of the concepts and techniques for developing integrated basic skills and job technical training from the military to civilian settings. At Indiana University, Dr. Larry Mikulecky and associates have recently described integrated basic skills and job skills programmes that they developed for word processing and wastewater treatment workers (Mikulecky and Stranse, 1982).

At the University of Minnesota, adult education Professor Dr. Rosemarie Park has initiated college courses to teach adult and vocational education teachers how to integrate basic skills and job skills training and she has assisted a number of businesses and industries in moving in the direction of integrated basic and job skills training (personal communication, January 1983). Additionally, the Polaroid Corporation has for some years offered job-related basic skills programmes for employees (personal communication from Rosalyn Stoker of Polaroid's Cambridge, Massachusetts office). These efforts, though small in numbers and scale, suggest that it is possible to transfer the concepts and techniques developed in the military to civilian job settings (Datta, 1983, p. 167).

In the field of adult basic education in general, the last decade has witnessed a major shift away from the strictly academic credentials-oriented programmes to programmes that focus on the needs of adults. Stimulated largely by the Adult Performance Level study conceived and funded by the Division of Adult Education of the U.S. Department of Education, the Adult Performance Level project has led to the development of many programmes that integrate basic skills education with the content knowledge needed to cope with the large variety of problems that adults encounter (Adult Performance Level Project Staff, 1975). Thus, it is a much smaller step, today to move

toward integrated basic skills and job skills training for adults because the adult education establishment is knowledgeable of and committed to such functional, competency-based education for adults. And in some cases the functional, adult-oriented programmes have been certified as largely satisfying the requirements for a high school diploma (Adult Performance Level Project Staff, 1979). Thus, integrated basic skills and job skills training in business and industry might also provide access to the much needed credentials for working and for advancement in career paths.

Given the continued reporting of data that show the importance of parent (especially the mother's) education on the school achievement of their children (e.g. Profile of American Youth, 1982; Laosa, 1982); the existence of proven technologies, including new computer-based programmes that the military has developed for integrating basic skills and job skills training (Farr, 1983); and adult educators committed to functional education for youth and adults, the time appears propitious for re-examining our policies and practices for interrupting the inter-generational cycles of marginal living and marginal learning. Today the predominant approach is in effect to write-off as lost causes youth and adults who have not learned the basic skills well and to place billions of dollars in remedial money in school-based programmes for their children.

It may well be that a commitment to the continued development of youth and adults, that matches our commitment to the remediation of their children in pre-school and elementary school programmes, would pay double rewards. Through education of the adults, we might also improve the educability of their children.

CASE STUDY NO. 4 - EXTRACTED FROM "PROGRAMMES FOR IMPROVING OCCUPATIONALLY RELATED BASIC SKILLS"

(Reprinted from: Sticht and Mikulecky, "Job-Related Basic Skills: Cases and Conclusions", ERIC NCRVE Info Series No. 285, 1984, pp. 11-30)

To find ways to permit businesses, industries and other work organisations to expand their basic skills offerings, while satisfying organisational goals for cost-effectiveness in training, several research and development projects have recently been conducted that demonstrate how to integrate basic skills and job technical skills training. Three of these projects are reported here in case study format to describe approaches basic skills or vocational skills specialists can take to develop integrated basic and technical skills training programmes. Two of the projects are concerned with training in civilian settings, while the third project took place within a military setting.

During the early 1980s an increasing number of private consulting firms specialising in basic skills training began to make their appearance. Often such firms arranged and became service providers for co-operative training ventures involving businesses and municipalities. Such training programmes were designed and used before and during employment for occupational upgrading and often included components for improving job-related reading, writing and computation skills. Two such programmes are described here. (For more detail on these programmes see Mikulecky (1984).

A Public and Private Sector Co-operative Effort to Prepare CETA-eligible Workers as Competitive Word Processor Operators

A characteristic employment problem is the inability to find properly trained employees even though thousands of unemployed workers are available. In Chicago during 1981 and 1982, the local Private Industry Council faced such a problem with word processor operators for major industries and businesses. Positions paying over $20,000 per year were going unfilled.

A survey of businesses involved with the Chicago area Private Industry Council had revealed the need for trained word processor operators. Administrators of the Comprehensive Employment and Training Act (CETA) programme were interested in training CETA-eligible individuals for such jobs but did not have a lengthy history of co-operative efforts with business.

Then, a private consulting corporation, Technical Assistance Training Corporation (TATC), proposed developing a word processing training programme for applicants eligible for training provided through CETA. The programme was designed to integrate basic skills training with job training and used performance levels of employed word processor operators as criteria for programme completion.

Careful task analyses of on-the-job word processing were used to develop a curriculum based on realistic goals and expectations. Every attempt was made to assure employers that high standards would be met. The fact that a private business was doing the training seemed to help convince employers that trainers were sensitive to their needs.

Selection and Screening of Applicants for Training

The literacy ability level required to do well as a word processor operator is quite high (i.e. 10th to 13th grade level); therefore, success in the training programme was dependent, in part, on trainees being able to attain those literacy abilities in a relatively short period of time (14 to 20 weeks). In order to select trainees who were most likely to succeed from among the thousands of potential applicants, a series of literacy screening exercises was developed from actual job materials.

All trainees selected for the programme were CETA eligible (i.e. economically disadvantaged, unemployed or underemployed and identified as having particular difficulties in entering or advancing in private sector employment).

The screening procedures had selected individuals who were CETA eligible as well as also likely to succeed. If the first wave of trainees did not meet industry standards, it was highly unlikely that applicants in the second and third waves would be offered jobs. Applicants scoring significantly below the job literacy performance level of actual workers were not accepted because it seemed unlikely that they would gain more than two or three grade levels in job literacy abilities during the half-year programme. Experience with the first wave suggested that literacy levels needed to be even more stringent (above eighth-grade reading level) for applicants without some clerical experience. Such applicants needed more time mastering typing and machinery. The extra time usually came from language training.

The Training Programme

The amount of time a trainee would spend in any given area was dependent upon how much time he or she needed. Some trainees needed more emphasis on language improvement and others in machine skills. On average, 20 per cent of time was spent attending classroom presentations and 80 per cent working independently or in student work groups to master information presented in classes.

Assignments were planned to integrate language and machine skills. Much of the classroom simulated actual job demands. Students would compose business communication that other students would edit and later produce in final form on word processing equipment. A good deal of the work involved using actual business communication that was handwritten in rough draft form with editing notations. The job simulation training that integrated language and machine experience ranged from about 5 per cent of assignments the first week to nearly 100 per cent in the final weeks. Class assignments attempted to replicate the time constraints present in business performance. Though much of the work was done on an individual level, some work made use of worker teams, which again replicated workplace conditions.

The most clear-cut differences between this programme and school programmes had to do with application and integration of training. TATC trainees actually used up-to-date word processing equipment and were aware of the industry standards they had to meet. Their training in language, work habits and machine use was integrated so that they received focused practice to meet those standards. Unlike much current schooling, the co-operative programme assumed no guaranteed transfer of basic skills training and consistently used job simulation as a major training device.

In 1981 and 1982, the economy entered a recession that limited the ability of co-operating industries to hire acceptably trained word processors. A third of the co-operating companies stopped all hiring.

Even in the face of these economic difficulties, slightly over 70 per cent of trainees found word processing employment by October 1982. Other trainees used the training facilities as a base for a job search club.

In summary, the word processing programme described here is an excellent example of how trainers can integrate basic skills training with on-the-job training while employing insights from current research.

An Urban Retraining Programme for Wastewater Treatment Workers

A second type of co-operative venture involves the retraining of workers for the new basic skills and technical demands of a job that is changing. An urban municipality had recently opened a new wastewater treatment plant as a result of new clear water guidelines. The new plant incorporated several technical innovations. Workers who needed little technical training to work in the old treatment plant faced an entirely different situation in the new plant. Newer, more effective treatments called for the use of cryogenics (super-cooled oxygen and nitrogen), dangerous chlorine gasses and the monitoring of environments for micro-organisms by using computers.

As the old plant was being phased out, workers needed to be transferred to the new plant. Before workers could be transferred, however, they needed to be retrained. This retraining involves (1) learning how the new process and equipment functioned, (2) learning safety precautions when working with a variety of dangerous gases, and (3) learning how to maintain the micro-organisms essential to the wastewater treatment. Mistakes made through ignorance could be costly in terms of loss of life, plant shutdowns and equipment and organism replacement. The unstated implication of the training programme was that workers unable to be retrained adequately could not be transferred to the new plant when the old one was totally phased out. Unemployment or job demotion seemed the only alternatives available.

The Retraining Programme

The municipality initially contracted with an engineering firm to provide technical retraining for workers. The firm had previous experience in retraining engineers and in gathering the best technical expertise available to upgrade technicians efficiently. The firm developed a technical curriculum and arranged for workers to be paid for attending classes for full days. The trainers were working under the pressures of accomplishing retraining goals with a minimum loss of worker time on the job.

Relatively soon in the retraining process, it became apparent that the usual technical retraining procedures would not be sufficient for a large percentage of the wastewater treatment workers. Many workers read below an eighth-grade level and several read below a third-grade level. Classroom training materials ranged in difficulty from 11th-grade to college level and included heavy use of graphs, charts and schematics. Actual on-the-job

explanatory material was nearly as difficult. In addition, many of the workers had little or no familiarity with concepts to be covered in the brief, high-powered technical classes.

The engineering consulting firm set up a co-operative relationship with a university consultant and hired a university-trained reading specialist to develop a basic skills component for the retraining programme. In addition, the trainers integrated the use of micro-computers to provide more individual practice and feedback to students.

All workers were to be retrained for possible positions in the new plant. Workers identified as having difficulties with literacy spent three additional afternoons a week with a reading specialist. The reading specialist concentrated on occupationally related basic skills demands with these students and on teaching content reading techniques to the engineers who taught the morning classes.

Working with Students

Developing rapport and trust was of primary importance in working with trainees referred to the reading specialist. The reading specialist estimated that nearly 80 per cent of these trainees were extremely nervous and worried about appearing to be ignorant or retarded. Most had experienced difficulty in public school and over a quarter had negative experiences in adult basic education classes. Initial attempts to diagnose basic skills difficulties in an efficient, clinical manner resulted in trainees refusing to return.

The major academic goal was to help trainees gain mastery of technical vocabulary, concepts and materials. the reading specialist set up special study guides to break down assignments into manageable tasks. Special help was given in interpreting graphs and schematic diagrams.

In some cases, the specialist was able to rewrite or redesign training materials to lower difficulty levels. Students would be asked to read general material at a difficulty level they could handle independently. Some used simple rewrite tests and handouts to lower difficulty levels. In many cases, difficulty levels were lowered by 40 per cent without noticeably losing content. The average mastery level of students whose instructors used rewritten materials improved significantly over students whose instructors did not adjust the difficulty level of their reading materials.

Programme Results

. The amount of special training received by workers varied depending upon need and the demands of the particular technical class they were attending at any given time. An average of 20 per cent of the workers received some form of special help. Trainee time on task during a typical day ranged from 30 to 50 per cent (which is comparable to an average high school).

The basic skills component of the retraining programme can be judged a success by several standards. Nearly half the students who took special basic skills training passed their technical class post tests. Gain in general reading ability was less encouraging. Only about 10 per cent of the students taking special training made noticeable gains in their ability to read general material or new material for which they had received no direction or purpose provided by the teacher. According to the reading specialist, students making the most significant gains in job and general reading ability invested 5 or more hours per week in outside reading of material at an appropriate difficulty level.

Areas of greatest programme weakness were very similar to weaknesses in traditional schooling. Since basic skills training was not integrated with technical training from the beginning, the effectiveness of such training was severely limited. The reading specialist could provide some remedial attention to referred trainees, but follow-up reinforcement in technical classes depended upon the specialist's success in convincing technical instructors to modify teaching techniques. Instruction was often fragmented, much like traditional schooling.

Conclusions

There are several conclusions suggested by these two case studies. It does appear possible to make fairly rapid gains in the ability to comprehend technical material if training is focused on that material. General literacy improvement, however, was not a noticeable direct by-product, but did occur with sufficient time on task (5 hours per week) with appropriate general material. Best results seemed to occur when basic skills training was integrated with technical training. Training that employed job simulations and applications of literacy increased trainee time on task. Actively involved students received up to three times more practice per paid day than did traditionally trained students. The integrated programme, therefore, is also more attractive from a cost-effectiveness perspective.

Probably the most significant conclusion to be drawn is that successful technical and basic skills training programmes are beginning to emerge in the vacuum left unfilled by traditional schooling. Where schools are unwilling or unable to match basic skills training and materials to specific occupational needs, private consulting firms are successfully filling the gap. They are successful to the degree that they do not assume transfer from general basic skills training to specific job training. Matching training to the application required on-the-job appears to be the key.

Occupational Literacy Training in the U.S. Department of Defence: The FLIT Programme

This section discusses projects that (1) identify the minimum competency levels needed to perform reading tasks successfully in several jobs within the United States Army and (2) develop a job-related functional literacy programme to bring marginally literate readers up to the minimum competency level established for the Army in the preceding research. Complete descriptions of the research and development can be found in Sticht (1975a, 1975b).

Identifying Minimum Competency Levels for Job-related Reading

To determine the literacy requirements of Army jobs, three different approaches were used. In these three approaches, the reading requirement of a job was established in terms of one of the following:

- Direct measures of job knowledge and job performance.
- The readability (reading difficulty level) of the Army manuals prescribed for use in learning and in doing the job.
- The specific job reading tasks inherent in performing the job.

This approach to establishing the reading requirements of jobs has the advantage of directly using job proficiency measures as criteria. It suggests that different jobs do have different levels of literacy demands. However, there are drawbacks to this approach. Clearly, it is prohibitively expensive to obtain hands-on job proficiency measures in a variety of jobs. A different problem arises from the job proficiency measures themselves, for they represent the resultant effect of many factors, of which literacy is only one.

Readability approach. The second approach to determining job reading requirements was to study the reading difficulty level of Army manuals used on various jobs. The FORECAST readability index was constructed to estimate the reading grade level of ability needed by the adult Army population to read and comprehend technical job reading materials. the formula for determining the reading grade level of job technical materials using this index is:

$$\text{Reading Grade Level} = 20 - \frac{\text{Number of 1 syllable words in a sample of 150 words}}{10}$$

This formula was developed using Army job technical materials administered as reading tests to young Army recruits. It is therefore a special readability tool for estimating young adult performance on reading tests (cloze format) consisting of job materials.

FORECAST estimates of the readability of manuals indicated these results:

- More than half of the job manuals in each of the seven jobs exceeded the 11th-grade level of reading difficulty.

- The average readability level of the materials in each of these jobs far exceeded the average reading ability of personnel working in these jobs.

The readability technique offers a low-cost method for estimating the overall reading demands of job manuals. However, it does not provide a direct indication of how well personnel can read and use their manuals for the reading tasks performed on-the-job; for this information, one needs to test people on samples of job reading tasks using job reading materials.

Job reading task tests. The third general approach to assessing job literacy requirements consisted of studying directly the relationship between general literacy skill and performance on job reading task tests, that is, reading tests constructed of actual job reading materials used in performing actual job reading tasks. Job reading tasks were identified by means of structured interviews with job performers at their work location. These job reading tasks were then structured into Job Reading Task Tests that were standardised and normed on Army samples whose general reading ability level was also measured.

These tests consist of the most frequently mentioned types of reading material and require the individual being tested to obtain the same kinds of information from the same manuals as job incumbents reported using in their work. Thus, they represent the most direct measure of actual job-specific reading task performance.

To summarise, these were the three main approaches to determining the reading-level requirements of jobs in the Army. Each studied the relationship of general reading ability to a different criterion: measures of job proficiency, the structural properties of job reading materials and the performance of empirically determined job reading tasks. These approaches agree in general in estimating substantially different reading requirements for different jobs.

From this work the following conclusion can be drawn: although no single level of functional literacy can adequately represent the reading requirement of the range of jobs studied, there appears to be a lower limit of seventh-grade reading level for functional literacy in the Army. Thus, remedial reading should be aimed at producing no less than seventh-grade reading ability and, optimally, should be targeted to the level of a job assignment.

Job Functional Literacy Training Programme

Based on the research on the nature of its literacy problem, the Army in 1971 sponsored the FLIT (Functional Literacy) project to develop a literacy training programme that would provide a level of functional literacy appropriate to present minimal job reading requirements and that would require no more than 6 weeks of training time. Given the absolute constraint of 6 weeks of training, there appeared to be no reasonable prospects of increasing the adult students' general literacy competence to the point where it would transfer significantly to job reading tasks. Accordingly, the FLIT objective was specified to be that of producing a student capable of using job reading materials with the effectiveness of a person having a general reading ability of grade seven or higher, as indexed by performance on a job reading task test.

Programme overview. The functional literacy training programme consisted of three curriculum strands, each of which occupied about one-third of each training day. Strand I was designed to provide training in the application of existing general reading skills to job-specific Army job reading tasks. Strand II was designed to improve basic reading skills and job knowledge by using simplified versions of Army job reading materials and special "information representation and transformation" procedures described later. Strand III was a free reading period allowing students to read from job-related materials of their choosing. Strand III is not discussed further in this report.

Strand I. Strand I training was designed to give the student drill and practice in applying existing reading skills to the job reading tasks and the job reading materials that were encountered in entry-level job training and job performance. This strand was a modular, self-paced, mastery-based programme of job reading task training.

Strand II. In contrast to the individualised, self-paced programme of Strand I, Strand II was a teacher-oriented programme designed to improve comprehension and learning skills using job reading materials. To read for learning, people must be prepared in at least two ways: they must have the knowledge base to comprehend the material to be learned and they must possess knowledge of skills for studying materials and relating what they read to what they already know.

Summative evaluation of the overall programme. Summative evaluation of the Functional Literacy (FLIT) Project was accomplished through pre- and post-training administration of alternative forms of the reading comprehension portion of the U.S. Armed Forces Institute (USAFI) Intermediate Achievement Test and the FLIT Job Reading Task Test (JRTT). Effectiveness of the FLIT reading training programme can be assessed by the gain on these composite measures of general and of job reading performance over the 6-week period of FLIT training.

TABLE I

SUMMATIVE DATA FOR THE FUNCTIONAL LITERACY (FLIT) PROGRAMME

Type of Reading	N	Reading Grade Level		
		Entry	Exit	Gain
General Reading (USAFI)	714	5.3	6.0	0.7
Job Reading (JRTT)	714	5.2	7.3	2.1

Table I presents the data on the mean USAFI and JRTT reading grade level (RGL) of FLIT students. In these data, which are free of the regression artifact that has flawed the assessment of so many remedial reading training programmes, students enter FLIT performing both general and job reading tasks equally well (or poorly) - low in the fifth-grade reading level. After 6 weeks of FLIT training in general and in job reading, students have gained 2.1 RGL years on the JRTT measure of job reading (3 times the gain made in general reading) and the end-of-course average JRTT score exceeds slightly the targeted course objective of RGL 7.0. The 0.7 RGL gain on the USAFI measure of general reading is in full accord with typical findings of adult general reading training programmes of from 50 to 100 hours of instruction.

Additional evaluation test data. Additional evaluation data were obtained that compared the job literacy training achievements to reading improvement by a group of Army personnel who received job technical skills training, but no literacy training. Results showed superior gains in job-related reading for the reading training group. Similarly, comparisons of the functional-literacy-trained students to students in Air Force and other Army literacy training programmes indicated that the functional literacy training produced two to four times the amount of improvement in job reading as the general literacy programmes did, while the job reading programme equalled the general literacy programmes in the amount of general reading test improvement accomplished.

Summary and Conclusions

A programme of research and development was summarised that (1) developed methodologies for the study of literacy requirements of jobs within a specific organisational setting, the United States Army, and applied these methodologies in determining the reading requirements of a set of Army jobs and (2) designed, developed, evaluated and implemented an operational, job-related, functional literacy (FLIT) programme for the Army.

Results of the above activities indicate that in the job reading training programme, job reading of job materials showed larger gain than general reading. This is important because it indicates that people are learning what they are being taught in a very specific manner. In many evaluation studies, standardised reading tests are used to evaluate programmes with no good rationale as to why it is believed the test scores should improve. Usually, there is no demonstration that the standardised test scores reflect what is being taught. Clearly, the present results show that "reading" is not altogether a general skill, assessable by any test of "general" reading.

The fact that general competency in a specified domain was improved in the job-related reading programme suggests that if reading training is given in a well-specified domain, then skill in that domain should improve. If enough domains are developed and if competency is assessed in these domains using appropriate domain-referenced assessment tests, then a person's "general" literacy should increase in proportion to the domains in which competency is achieved. This way, "general" ability is improved through the aggregation of "specific" abilities. It remains to be determined whether domains that cut across a number of other domains of specialisation can be identified and directly taught as superordinate, generic skills of "general" literacy.

CASE STUDY NO. 5 - EXTRACTED FROM "EXPERIMENTAL FUNCTIONAL SKILLS PROGRAMME IN READING (XFSP/READ)"

(Reprinted from "Teachers, Books, Computers and Peers: Integrated Communications Technologies for Adult Literacy Development" by Sticht, et al., 1986, pp. 1-8)

In an ongoing programme of instructional development, the authors and other colleagues from the Naval Postgraduate School and the Navy Personnel Research and Development Centre are developing 45 hour developmental reading and mathematics programmes for the Navy under sponsorship of the Chief of Naval Education and Training. The programmes we are developing will replace programmes being offered by a dozen or so contracting organisations worldwide.

This paper will focus on the Experimental Functional Skills Programme in Reading (XFSP/Read). We will first discuss the conceptual framework for the development process, including a simple model of the human cognitive system, the concept of functional context training and the integrated communications technologies approach that brings together teachers, books, computers and peer instruction in a flexible delivery system that can meet the needs of both students and the Navy organisation.

In addition to the foregoing, this paper also provides an overview of a new approach to adult literacy assessment that moves away from the use of reading grade level scores to more appropriate Rasch item transform scores. The new assessment approach measures reading-to-do, reading-to-learn and, for the first time in a reading assessment battery, content knowledge gained in the programme. The latter, that is domain knowledge, is then used to illustrate a new method for assessing the readability levels of content materials that takes account of a person's background knowledge in estimating the general levels of reading needed to comprehend school or work materials.

Human Cognitive System Model

In conducting the development of the XFSP Reading programme we have worked from a stripped-down, simplified model of a human cognitive system and the processes the system uses for extracting and representing information in the environment. The model is one which possesses both oracy and literacy

information processing skills. The literacy processes include all those used to recode written language into internal forms comparable to those used in oral language and, in addition, to perform all those literacy tasks that are not instances of writing as a second signalling system for speech. The tasks unique to literacy are those made possible by the properties of graphic displays: they are more or less permanent (thereby permitting study), they can be arrayed in space (permitting the construction of forms, signs, flow charts, graphs, etc.) and they can use the properties of light (contrast, colour) to guide attention and facilitate information processing.

According to the model, the performance of literacy tasks requires knowledge about what one is reading or writing (including mathematics knowledge when reading in that domain); processing skills for thinking about what to communicate or for comprehending what others communicate; and of course, graphic displays of information in the environment to be processed for meaning. An important implication of this analysis is that it reveals that literacy, considered as the ability to comprehend and use the graphic symbol systems of writing, graphing, illustrating, mathematics and so forth, can be enhanced by improving either one's knowledge base in a given task domain, or one's processing skills or, as in the case of improving the readability of materials, through the redesign of the graphic information displays the cognitive system must deal with, or a combination of these factors.

The "Functional Context" Concept

The essence of this approach is contained in two major goals for instruction. First, always try to make the instruction as meaningful to the learner as possible in terms of the learner's prior knowledge. This facilitates the learning of new information by making it possible for the learner to relate it to knowledge already possessed or to make it possible for the learner to transform old knowledge into new knowledge. Second, as much as possible, use the materials and equipments that the learner will use after training or education as part of the instructional programme. This will motivate the learner by showing that what is being learned is relevant to a future goal and it will promote transfer of learning from the classroom to the next training or "real world" activity. In short, the functional context method of instructional design attempts to motivate and promote learning and transfer by making the programme meaningful in terms of the learner's past, present and future.

Integrated Communications Technologies

The design of the XFSP/Read instructional delivery system is based on the premise that teachers, books, computers and peers all form a set of communications technologies, based on human language and information processing skills that can be applied to socially organised tasks in classrooms aimed at bringing about learning. (See the Laboratory of Comparative Human Cognition Newsletter, July 1982; 1985 for related concepts). On this premise, teachers interact with students to present concepts and to model comprehension tasks for students. Peer teams perform complex analysis tasks, such as making semantic maps of texts and then representing these maps as flow charts, matrices, outlines, or tree structures. This simulates teamwork on-the-job to accomplish difficult cognitive and communication tasks. The contents and information processing skills that are taught in textbooks are reinforced through the use of micro-computers that offer discrete "game-type" activities and integrated computer-based instruction. The goal then has been not to see if teachers, books and social learning by peers can be replaced by computers, but rather to find ways to better use all these technologies to the advantage of the learners and the sponsoring organisation.

The XFSP/Read Programme

The XFSP Read programme was developed following the guidance of the concepts described above, applied in studies of what kinds of tasks Navy personnel perform, using reading skills in training and job settings. In this research, students, instructors and job performers in ten Navy jobs were interviewed and asked for information regarding two major types of reading tasks: reading-to-do something and reading-to-learn something. In a reading-to-do task, the person is performing some job task, needs some information from a document, looks-up the information, holds it in working memory long enough to apply it and can then forget it. In a reading-to-learn task, the person reads information to be stored in long-term memory as part of the knowledge base and then retrieves it (or a reconstruction of it) for use at some later time, such as taking an end of week test, or for performing a task on-the-job.

The interviews with personnel revealed that on-the-job reading-to-do comprised about three-fourths of the reading tasks. It was also found that the processing skills performed in reading-to-learn were more complex than those used in reading-to-do. Whereas the latter emphasised information location and extraction skills, such as use of tables of content, indexes, "thumbing" or "flipping" through or searching tables and figures, reading-to-learn involved more elaborate activities to merge new information with old knowledge.

The interviews also revealed the role of the knowledge base in performance of reading tasks. For instance, it was found that close to 60% of job tasks involving reading had been performed previously and for about half of the 325 reading tasks cited by the sample of 178 personnel, additional reading related to the task had been performed and for two-thirds of these cases, the related reading helped in reading the material cited in the interview (see Sticht, Fox, Hauke, and Zapf, 1977 for a more complete description of this work).

The Career Progression Reading Programme

On the basis of the foregoing research and additional study of the reading demands of the Navy environment, we have designed and developed a reading programme that has a functional context for Navy personnel in that the programme uses Navy content derived from materials they must study to pass promotion tests and the information processing skills are of immediate use to them. Most of the students are "mid-level" literates, with reading skills in the 6th to 10th grade levels, and most have had one or more years of duty, and so they are able to relate their knowledge base to the content of the course.

Functional Reading Assessment Battery

In addition to the functional, Navy-related, standardised teacher, book- and computer-based instructional programmes, we have also developed a new reading test battery to test Navy-related reading (reading-to-do, reading-to-learn, and Navy Knowledge). The latter, that is knowledge gained, is rarely measured in reading programmes because reading is considered as a content-free, process skill. But the human cognitive system model makes clear that knowledge of what one is reading is required to make reading comprehension possible. So we are assessing the improvement in knowledge as a function of participation in the functional reading programme.

An Evaluation Study

In a small evaluation study, the improvement of a sample of students who took a general reading programme offered by education contractors was compared to the improvement of students in our functional reading programme on three tests: a general reading test that gives grade levels of performance, our Navy reading-to-do test and our Navy Knowledge test (the reading-to-learn test was not available at this time). The results show that, in general, people tend to learn what they are taught. The general reading programme did better on the general reading test, but this did not transfer to the Navy reading and knowledge tests to any significant degree. The Navy-related reading programme, on the other hand, resulted in only a little improvement on the general reading test, but made consistent improvements where it counts for Navy personnel, that is, in their Navy reading and knowledge.

Knowledge-based Readability Analysis

With the new Navy Knowledge test, we have been able to develop a new approach to estimating the reading grade level of Navy materials taking into account the knowledge of Navy materials that people who are expected to read the materials might have. This approach is based on the cognitive system model that points out that reading comprehension requires prior knowledge of what is being read.

In the present work, Navy personnel were administered the new Functional Reading Assessment tests. Test results showed that as the amount of background knowledge increases from low to high, the estimated reading grade level needed to comprehend the passages at 70% correct drops rapidly until, at the highest background knowledge level, the estimate is that a 6.0 reading grade level of general literacy skill would suffice (additional information on these preliminary findings is presented in Chang, 1985; more detailed analyses are underway).

The foregoing offers support for the knowledge-based approach that is being followed in developing the XFSP/Reading programme for the Navy. It makes the point that background knowledge facilitates reading comprehension. This is important when adult literacy programmes aim to provide literacy competence in limited domains, such as work-related literacy training. These

findings, and this approach suggest that both more generally useful information processing (reading and communications) skills can be developed within the contexts of content materials. The information processing (literacy) skills do not have to be acquired prior to education or training in a functional domain. Rather, both content knowledge and literacy skills can be developed together and both contribute to improved reading comprehension.

CASE STUDY NO. 6 - "THE U.S. DEPARTMENT OF LABOR'S JOB CORPS EXPERIENCE IN WORKING WITH THE TRULY DISADVANTAGED"

The Job Corps remedial education programme is the most widely and continuously used, as well as carefully assessed, system outside the schools for upgrading the basic academic competencies of the economically and educationally disadvantaged. Over nearly two decades of use in Job Corps and in varied applications in the Armed Forces, prisons and local employment and training programmes, this system of individualised, self-paced instruction has demonstrated its feasibility and effectiveness in working with populations who have failed in or been failed by the traditional educational approaches. Nearly a million young adults have received instruction in Job Corps. These are the dropouts and pushouts from the schools. Only one in seven Corps members has a high school diploma and the tested reading and mathematics competencies at entry are below the sixth grade level. Lacking the ability to read and write at the most basic levels, Job Corps entrants have had little success in the labour market. A third have never had a regular job. In the six months before enrolling, they have averaged four hours of minimum wage employment weekly. Lacking basic competencies, they cannot get started on career ladders. A fourth have applied for and have been rejected by the Armed Forces. Even local training programmes for the disadvantaged close their doors to these dropouts, or shunt them to short-term work assignments, since they cannot master vocational skills training.

Job Corps and specifically its education components, are not a miracle cure for these deepseated problems. The typical Corps member has spent over ten years in the regular education system to gain less than six grade levels of reading and mathematics skills. The average stay in Job Corps is only eight months. During this time, academic instruction is only one component of a comprehensive programme including vocational training, work, pre-employment skills training, health classes, recreation and the like. Typically, remedial education classes are scheduled only two to three hours daily and 100 hours in mathematics or in reading will require five months of participation in Job Corps. Students entering Job Corps have averaged approximately 13,000 hours of regular schooling, including several thousand hours of instruction in reading and several thousand in mathematics. If Corps members gained at the school norm (one grade per ten months of school), a five-month stay in Job Corps would yield only half a grade improvement in reading and in

mathematics. If Corps members gained at the rate they previously achieved in school the expected gains would be just a fourth of a grade. Even with gain rates several times as high, few can rise to the point where they can secure a high school equivalency diploma or where they can enter meaningful career training when they are starting out so far behind, unless they remain beyond the average length of stay. On the other hand, the gains which can be achieved during six months are quite important. A grade level gain would represent a one-fifth improvement in academic skills for the average Corps member. It might provide the wherewithal to read a job application or newspaper, to multiply or divide, to be able to interpret safety rules, or to successfully meet other challenges which are a part of adult life.

Reading and Mathematics Gain Rates

A range of studies have documented that the Job Corps remedial system whether used in residential centres or in other community-based applications, yields educational gains far exceeding the rates previously achieved by educationally and economically disadvantaged students, frequently exceeding nationwide school norms and well above the learning rates averaged by students in adult basic education and other remedial instruction efforts.

Summarising across these varied studies, it appears that 100 hours of instruction using the individualised, self-paced Job Corps curricula improves tested skills by a little over a grade, while the same exposure to the mathematics programme will raise tested competencies between a grade and a quarter and a grade and a half. Where instruction is provided as a supplemental activity, averaging two hours daily split evenly between reading and mathematics, the monthly gain rates are 50 to 100 per cent above school norms in reading and double to triple school norms in mathematics. These gains are realised by individuals whose previous achievement rates were half of the school norms. Put another way, a six-month stay in a two-hour daily educational component using Job Corps materials can be expected to raise mean skills by at least a grade in reading and a grade and a half in mathematics.

Comparative Performance

The only widely used curricula that comes close to Job Corps in its documented gains is the Individualised Manpower Training System, very much like the Job Corps educational programme, which was developed under Department

of Labor funding in the 1960s and has been utilised for over a decade in South Carolina. According to unpublished data collected from 1978 to 1980 on all enrollees, reading gains averaged 1.8 grade levels per 100 hours of time in task and mathematics gains averaged 1.5 grades per 100 hours of time in task. Assuming 70 per cent of time in class is spent on task, this translates into gains per class hour in reading comparable to or better than those in Job Corps, but mathematics gains somewhat lower. (Unpublished data, State of South Carolina).

In summary, it appears that run-of-the-mill adult basic education programmes achieve a half to three-fourths of a grade level of gain in 100 hours of instruction. Exemplary programmes are able to achieve approximately one grade level gain in 100 hours of instruction in reading. Mathematics gains per instructional hour are somewhat higher. Considering the severe economic and educational hardship of the Job Corps population, it is noteworthy that the average gains of Corps members, as documented by a range of studies, equal or exceed the gains achieved in the best of local programmes and are roughly double the average of remedial education programmes nationwide.

ANNEX

A Developmental Model of Literacy:

Given the dynamic nature of literacy, its close ties with success in life and work, and our need in the U.S. to develop a workforce that can compete in an increasingly competitive world marketplace, a new developmental model is emerging.

Sticht (1983) provides an overview of a developmental model of literacy that proposes that the development of literacy, language, and knowledge is a lifetime activity. It starts with a newborn infant seeing and hearing things in his external environment. These external stimuli are then internalised in working memory by the child as he/she develops (sensing, moving and thinking), and finally the working memory merges with long term memory to construct an internal representation of the world at a point in time.

As the infant develops from this stage of relatively automatic processing, a second stage of conscious control over information pick-up and manipulation can be noted. This active process of attending to information distinguishes listening from hearing, and looking from seeing, as information pick-up processes. Listening and looking build internal representations called images.

Images may also be constructed from data stored in long-term memory. These internal imaging processes are frequently assessed in aptitude tests as "spatial perception" or "mechanical comprehension" in which it is necessary to mentally visualise and rotate cog and gear assemblies to determine what effect this movement might have on some other gear. It is during this stage that working memory becomes active. This memory is limited and can be overloaded by, for example, attending to several things at the same time. The individual learns techniques to overcome these limits (e.g., repeating information until it can be applied).

A third stage represents the development of language processes out of earlier processes and knowledge stored in long-term memory. In developing oral language, the listening process is used in attending to spoken language to learn the words and grammar of language. Thus, listening plus "languaging", occurs simultaneously. This joint occurrence is given the special name of auding. On the production side, the joint occurrence of uttering (making sounds through the mouth) with the production of word forms from the language pool, and stringing the word forms together to make sentences using the rules of grammar, produces the special process called speaking. Auding and speaking comprise the oral language information reception and production skills.

Speaking is used to represent information that the person has in his or her mind "outside the head" and in the acoustic medium, while auding is used to pick-up and decode speech information displays into knowledge in the mind of the listener.

In the final stage, the learner both reads and writes; translating and transforming the oral language to and from the graphic form.

"The model holds that the development of the oracy skills of speaking and auding is built upon the development of the prelinguistic cognitive content through intellectual activity which I call conceptualising ability. It is important that it be understood that this early, prelinguistic cognitive content, or knowledge, will form the foundation for the acquisition of new knowledge over the person's lifetime."

Much of this knowledge will remain personal, and will not be explicitly represented in language for communication to others. Nonetheless, such personal, tacit knowledge, which includes perceptual learning and general knowledge of "how the world works," will be absolutely necessary for the learner to comprehend the spoken, and later the written, language. This reflects the fact that language is selective in the features and concepts chosen to be represented. We may think of language as producing a verbal figure, which can be comprehended only in terms of its relationship to a non-linguistic conceptual ground of "world knowledge." A simple illustration of the role of personal or "world knowledge" in literacy training is seen in the recommendation to give students experience with objects and events in the world through field trips, demonstrations, movies, etc., before they read about them. This approach provides an experiential base or "world knowledge" which will permit a deeper comprehension of the words and concepts the students read.

A final aspect of the model is that it recognises that, on the one hand, the literacy skills of reading and writing utilise the same cognitive content used in auding and speaking, plus the special decoding and encoding skills of reading and writing. On display--characterised by being more or less permanent, being arrayed in space, and utilising the features of light (color, contrast)--makes possible the development of skills and knowledges entirely different from those involved in oral language.

The model incorporates the role of prelinguistic looking and marking abilities as contributors to later utilisation of the visual display of written language in conjunction with lines, white space, and colour to develop graphic tools such as matrices, flow charts, colour-coded graphs, and the like. These tools combine with written language and non-language graphic symbols, such as arrowheads and geometric figures, to produce analytical products beyond those obtained through the fleeting, temporal oral language.

The point to be emphasised is the fact that much of the acquisition of literacy is not simply learning to read; that is, it is not just learning a language system that can be substituted for the oral language system. Rather, a large part of learning to be literate, and perhaps the most important part for acquiring higher levels of literacy, is learning how to perform the many tasks made possible by the unique characteristics of printed displays--their permanence, spatiality, and use of light." (Sticht, 1983, pp. 1-34)

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